

# PHARMACOLOGY AND TOXICOLOGY, MASTER OF SCIENCE (M.S.)

## Program goal

The graduate program leading to the Master of Science in Pharmacology and Toxicology prepares individuals for a variety of career objectives in biomedical science. These careers include but are not limited to as industrial scientists and scientists in government regulatory agencies. The M.S. program will be of interest to individuals planning on pursuing technical positions in pharmacology or toxicology research or testing; students interested in the health professions, such as medicine or dentistry, who desire additional research training; and those interested in government positions, such as those in regulatory agencies, that require training in pharmacology and toxicology.

The program incorporates formal instructional activity and research training mentored by members of the graduate faculty. The master's program is distinguished from the Ph.D. degree offered by the department in that the M.S. student is not being prepared for a career as an independent investigator.

## Student learning outcomes

### SLO 1: Communication skills

The candidate will demonstrate the achievement of an appropriate level of oral communication skills with respect to the content, organization, logical flow, presentation and appropriate use of language incorporating the use of visual aids, as measured by rubric. The candidate will demonstrate the achievement of an appropriate level of written communication skill with respect to grammar, syntax, spelling and use of vocabulary to effectively present information including the use of figures, tables and citations as measured by rubric.

- Measure 1.0: Course work presentations
- Measure 2.0: Performance review of progress
- Measure 3.0: Thesis review and examination

### SLO 2: Integrated knowledge of bioscience

The candidate will demonstrate an appropriate level of knowledge of the current elements of the biosciences as related to disciplinary specialization and a more detailed understanding of the individual area of scholarship, including an appropriate familiarity with the research literature and the ability to evaluate and critique publications as measured by rubric.

- Measure 1.0: Performance review of progress
- Measure 2.0: Thesis review and examination

### SLO 3: Problem-solving skills

The candidate will demonstrate an appropriate level of skill in the identification and selection of meaningful problems to be addressed in bioscience research, including the ability to defend said identifications and to design and develop appropriate methods to solve said problems as measured by rubric.

- Measure 1.0: Performance review of progress
- Measure 2.0: Thesis review and examination

### SLO 4: Experimental design

The candidate will demonstrate the achievement of an appropriate level of competence in the ability to appraise, modify and/or create, and implement experimental protocols and to design and develop experiments as measured by rubric.

- Measure 1.0: Performance review of progress
- Measure 2.0: Thesis review and examination

## VCU Graduate Bulletin, VCU Graduate School and general academic policies and regulations for all graduate students in all graduate programs

The VCU Graduate Bulletin website documents the official admission and academic rules and regulations that govern graduate education for all graduate programs at the university. These policies are established by the graduate faculty of the university through their elected representatives to the University Graduate Council.

It is the responsibility of all graduate students, both on- and off-campus, to be familiar with the VCU Graduate Bulletin as well as the Graduate School website (<http://www.graduate.vcu.edu/>) and academic regulations in individual school and department publications and on program websites. However, in all cases, the official policies and procedures of the University Graduate Council, as published on the VCU Graduate Bulletin and Graduate School websites, take precedence over individual program policies and guidelines.

**Visit the academic regulations section for additional information on academic regulations for graduate students.** (<https://bulletin.vcu.edu/academic-regs/>)

## Degree candidacy requirements

A graduate student admitted to a program or concentration requiring a final research project, work of art, thesis or dissertation, must qualify for continuing master's or doctoral status according to the degree candidacy requirements of the student's graduate program. Admission to degree candidacy, if applicable, is a formal statement by the graduate student's faculty regarding the student's academic achievements and the student's readiness to proceed to the final research phase of the degree program.

Graduate students and program directors should refer to the following degree candidacy policy as published in the VCU Graduate Bulletin for complete information and instructions.

**Visit the academic regulations section for additional information on degree candidacy requirements.** (<https://bulletin.vcu.edu/academic-regs/grad/candidacy/>)

## Graduation requirements

As graduate students approach the end of their academic programs and the final semester of matriculation, they must make formal application to graduate. No degrees will be conferred until the application to graduate has been finalized.

Graduate students and program directors should refer to the following graduation requirements as published in the Graduate Bulletin for a complete list of instructions and a graduation checklist.

Visit the **academic regulations** section for additional information on graduation requirements. (<https://bulletin.vcu.edu/academic-regs/grad/graduation-info/>)

## Other information

### School of Medicine graduate program policies

The School of Medicine provides policies applicable to all programs administratively housed in the school. Information on **master's programs** is available elsewhere in this chapter of the Graduate Bulletin.

Apply online today. (<https://www.vcu.edu/admissions/apply/graduate/>)

## Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
M.S.	Fall	Applications received prior to Jan 15 given priority consideration	
	Summer	May 1	

## Special requirements

- See the departmental website for additional information on the application process.

In addition to the general admission requirements of the VCU Graduate School (<https://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements/>), qualified applicants to the M.S. degree program typically should have:

1. Baccalaureate degrees with a major in fields such as biology, chemistry, biochemistry, pharmacy, psychology or related sciences
2. Minimum undergraduate GPA of 3.0
3. Several hours of laboratory research experience

## Basic science, research-intensive, non-thesis curriculum for medical students

Individuals who are participants in medical training (the Doctor of Medicine program) at VCU may be eligible for enrollment in a research-intensive, non-thesis graduate curriculum. This basic science option builds on the core of disciplinary material embedded in the first two years of training in the medical school curriculum. Additional exposure is provided to specialized areas in basic science disciplines in concert with an intensive research experience leading to the preparation of a report in the form of a manuscript suitable for publication. The program is designed to be completed within 12 to 15 months. Subject matter related to the core material and/or suitable elective courses taken in the didactic phase of medical training correspond to a minimum of the equivalent of 24 graduate credit hours. The equivalent of 12 credit hours may be applied to the M.S. degree program in which the student is enrolled in accordance with Graduate School policy. Medical students interested

in the basic science option should contact the M.S. graduate program director for additional information.

## Degree requirements

In addition to the general VCU Graduate School graduation requirements (<https://bulletin.vcu.edu/academic-regs/grad/graduation-info/>), students in the master's program must complete a minimum of 30 graduate credit hours.

The Master of Science in Pharmacology and Toxicology is a research-oriented degree program comprising graduate course work and supervised research leading to a master's thesis. Students must conduct a substantial original investigation under the supervision of their advisers and must prepare and defend a thesis reporting the results of this research. It is highly recommended that students identify mentors for dissertation research as soon as possible within the first semester to ensure timely progress in their research.

When the thesis has been completed, copies are submitted to the members of the student's graduate advisory committee. The student's GAC decides upon the acceptability of the candidate's thesis. If the committee unanimously accepts the thesis for defense, the candidate appears before them for a final oral examination.

M.S. students are required to present a departmental seminar prior to the final oral thesis defense as a requirement for completion of the thesis.

## Course requirements

Substitutions may be approved by the graduate program director.

Course	Title	Hours
<b>Required core courses</b>		
BIOC 503	Biochemistry, Cell and Molecular Biology	5
IBMS 600	Laboratory Safety	1
PHTX 630	Basic Concepts in Pharmacology for Graduate Students	3
PHTX 636	Principles of Pharmacology	5
PHTX 639	Principles of Pharmacology Journal Club	1
PHTX 690	Pharmacology Research Seminar <sup>1</sup>	1
<b>Required additional courses</b>		
OVPR 601	Scientific Integrity	1
or OVPR 602	Responsible Scientific Conduct	
or OVPR 603	Responsible Conduct of Research	
<b>Elective courses</b>		
Select three credits in advanced elective(s) in the specialty area.		3
ANAT 610	Systems Neuroscience	
BIOC 504	Biochemistry, Cell and Molecular Biology	
BIOC 530	Biochemistry, Cell and Molecular Biology Module 1: Protein Structure and Function	
BIOC 531	Biochemistry, Cell and Molecular Biology Module 2: Basic Metabolism	
BIOC 532	Biochemistry, Cell and Molecular Biology Module 3: Central Dogma of Molecular Biology	

BIOC 533	Biochemistry, Cell and Molecular Biology Module 4: Lipids/Membranes and Bioenergetics	
BIOC 601	Membranes and Lipids	
BIOC 605	Molecular Biology	
BNFO 653	Advanced Molecular Genetics: Bioinformatics	
CHEM 504	Advanced Organic Chemistry I	
EGRB 603	Biomedical Signal Processing	
EGRB 610	Microprocessor Interfacing for Biomedical Instrumentation	
FRSC 644	Analytical Considerations in Forensic Toxicology	
IBMS 635	Cellular Signalling	
MEDC 541	Survey of Molecular Modeling Methods	
MEDC 601	Advanced Medicinal Chemistry I	
MEDC 630	Theoretical Methods in Drug Design	
MICR 505	Immunobiology	
NEUS 609	Cellular and Molecular Neuroscience	
PHIS 501	Mammalian Physiology	
PHIS 604	Cell Physiology: Cardiovascular and Respiratory	
PHIS 615	Signal Detection in Sensory Systems	
PHTX/PHIS 620	Ion Channels in Membranes	
PHTX 632	Neurochemical Pharmacology	
PHTX 633	Behavioral Pharmacology	
PHTX 640	Pharmacology of Analgesics	
<b>Thesis research</b>		
PHTX 697	Directed Research in Pharmacology	10
<b>Total Hours</b>		<b>30</b>

(804) 828-7918

**Additional contact**

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**Program website:** [pharmtox.vcu.edu](https://pharmtox.vcu.edu) (<https://pharmtox.vcu.edu/>)

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Students are expected to enroll in PHTX 690 Pharmacology Seminar each semester. M.S. students are required to present a departmental seminar prior to the final oral thesis defense as a requirement for completion of the thesis.

**The minimum total of graduate credit hours required for this degree is 30.**

Students who complete the requirements for this degree will receive a Master of Science in Pharmacology and Toxicology.

## Typical plan of study

Many students often end up taking more than the minimum number of hours required for a degree program. The total number of hours may vary depending upon the program, nature of research being conducted by a study, or in the enrollment or funding status of the student. Students should refer to their program websites and talk with their graduate program directors or advisers for information about typical plans of study and registration requirements.

**Contact**

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